United States
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August 1998

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Forestry Research West

A report for land managers on recent developments in forestry research at the three western Experiment Stations of the Forest Service, U.S. Department of Agriculture.

Forestry Research West

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Cover

Since the 1800's, non-native fish have been stocked in high-elevation lakes that dot the Sierras of California. Scientists with the Pacific Southwest Station have sampled more than 2,200 of these lakes, and found that, while the fishing may be good, these non-natives are impacting other wildlife, such as this mountain yellow-legged frog. Researchers believe the frog may be an indicator species whose absence can signal a loss of biodiversity in a lake. Read more about their research, beginning on the next page.

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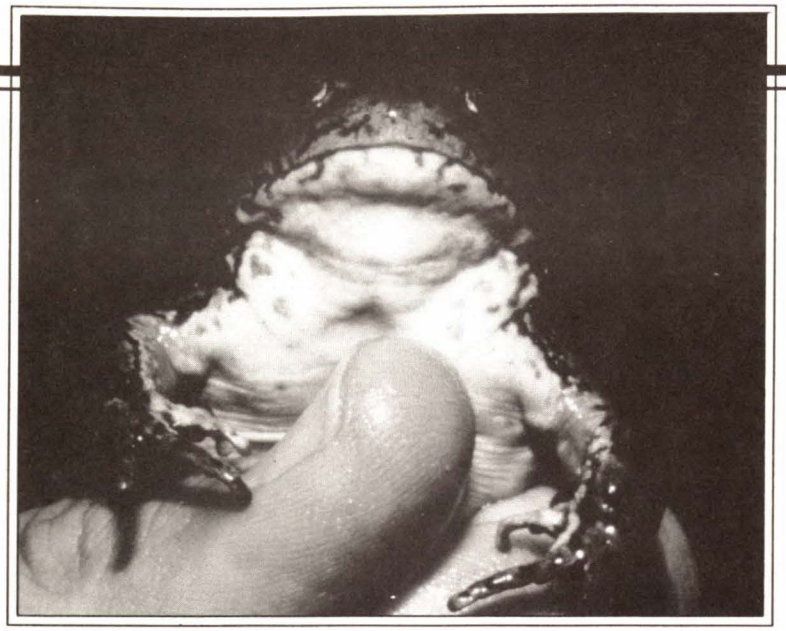
Frogs or Fish???

by Connie Gill and Kathleen Matthews, Pacific Southwest Station



Mountain yellow-legged frog.

For more than 150 years, high elevation Sierran lakes have been stocked with non-native fish for recreation fishing opportunities. The long-term impacts of this action have not been known, and good information was necessary to assess the situation. For this reason, a comprehensive inventory of these lakes was initiated by the Pacific Southwest Region, with researchers from Pacific Southwest Research Station (PSW), and the University of California Santa Barbara's Sierra Nevada Aquatic Research Laboratory (SNARL) doing the sampling/data collection work. The inventory was funded by Region 5, Fish and Wildlife Program of the National Forest System.

Kathleen Matthews an aquatic ecologist with PSW, and Roland Knapp of SNARL are the main investigators conducting this arduous project which has been in progress for the last three years.

"It has been the most comprehensive survey that's ever been done in the Sierra at these high elevations," Matthews said. "I'd say probably the most comprehensive survey that's ever been done anywhere on the impacts of introduced fish at high elevations."

The survey was conducted high in the Sierras where snow can sometimes be found year-round. Initiated in 1995, each summer the work began as soon as the snow melted enough to hike in. Those conducting the field surveys packed in all of their supplies including sampling bottles, tents, nets, and personal supplies. This was no easy feat at 9,500 to 12, 000 feet elevation.

"It's really hard work carrying around heavy packs in thin air," said Matthews. "In the John Muir Wilderness we couldn't use helicopters or anything like that to drop in our supplies because the wilderness must be protected. However, in Kings Canyon National Park the park Service dropped off some of our equipment at ranger cabins. They even flew in some stuff for us and it really helped a lot."

In the John Muir Wilderness and in Kings Canyon National Park, data were collected from more than 2,200 lakes. The main focus of the study was to discover where the fish, invertebrates, and amphibians are, trying to get an idea of the impacts of fish stocking in these areas.

The large-scale sampling is completed and it appears that at present, there is an overwhelming amount of data, so much that when the computer file gets moved around it usually brings down the IBM system at PSW.

"The most dramatic result we've seen is the impact of introduced fish on mountain yellow-legged frogs," said Matthews. "Mountain yellow-legged frogs may be an indicator species whose absence can signal a loss of biodiversity in a lake."

It appears that trout and frogs cannot both live in the same lakes, for if there are trout in lakes there are rarely any frogs or tadpoles. The developmental stages of this frog are important, it remains a tadpole for up to four years, confining it to the same habitat as that of the trout, thus more vulnerable to being devoured. Actually, the fish eat tadpoles and adult frogs. During the sampling, fish caught in gill nets had tadpoles and adult frogs in their stomachs. These frogs are small, adults are about the size of a fifty-cent piece.

High elevation Sierra lake.

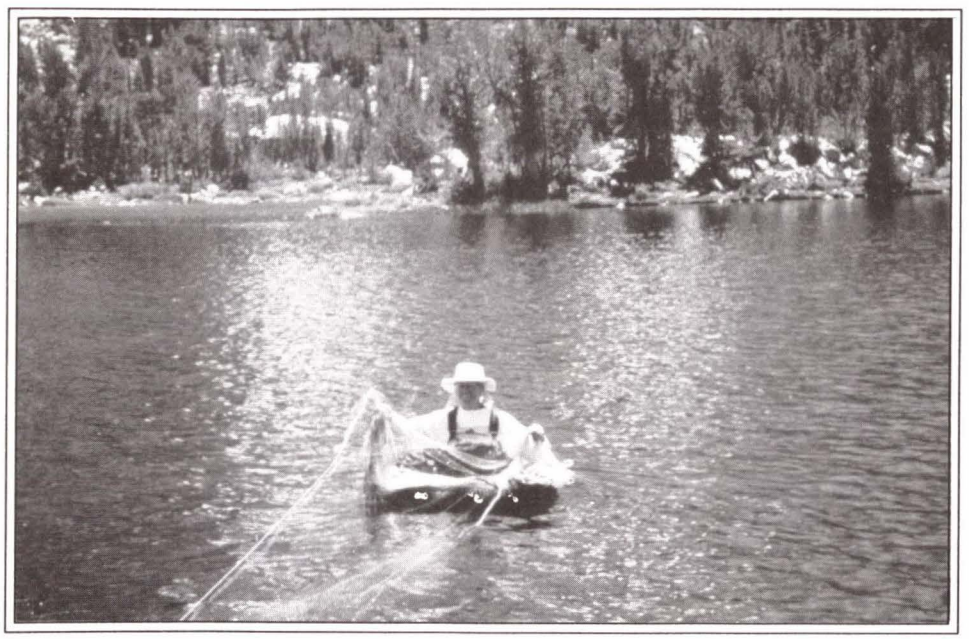
"There is no question that the decline of the mountain yellow-legged frog is dramatic, and there is no question that trout are playing an important role in mountain yellow-legged frog declines."

Many people mistakenly believe that fish in these lakes are native. However, there aren't any lakes in these areas with naturally occurring fish.

Some of the fish used to stock these lakes were also non-native to California such as the brook and brown trout. At first it was pretty experimental. The trout did survive quite well and for the most part are self-sustaining, reproducing in the lakes.

"If stocking was stopped tomorrow, there would still be fish in Sierra Nevada lakes for many, many years," said Matthews. "I suppose the second most dramatic result is that the majority of lakes support self-sustaining fish populations."

High Sierra lakes in the John Muir Wilderness are still being stocked with trout, and those in Kings Canyon National Park where stocking has been eliminated, were compared: 1,079 lakes were sampled in the John Muir Wilderness with mountain yellow-legged frogs in 56 lakes (5 percent); in Kings Canyon National Park, 1,083 lakes were sampled with frogs in 370 lakes (35 percent). Historically, frogs were common in both areas. In fact, early-recorded information indicated sightings of frogs in nearly every lake in the Sierra.



Today, in the John Muir Wilderness, the frogs have been almost eliminated because of stocking, and they have declined markedly in other places in the Sierra, especially in the Desolation Wilderness and other high elevation areas that are currently being stocked.

Setting the gill nets.

In Kings Canyon, fewer lakes were stocked than in Wilderness lakes, and in 1977 most stocking was stopped within the Park. With fewer lakes originally stocked and with the end of stocking in Kings Canyon, there are fewer fish. They are reproducing, but there are not as many to feast on the frogs.

Knapp said if nothing is done to prevent further decline, the mountain yellow-legged frog is likely to be listed under the federal Endangered Species Act, which would trigger federal actions.

"We believe introduced trout are playing a very significant role in the decline of the mountain yellow-legged frog," Knapp said. He also indicated that other elements were also suspect and being investigated such as acid rain, pesticide drift, and ultraviolet light.

An interesting fishery aspect is that there's fewer but larger fish in Kings Canyon, and in the John Muir Wilderness there are more stunted fish from years of continuing to stock without any real evaluation of whether they need to continue the practice or not. There's not enough food for the fish, they reproduce like crazy, and so there's a lot of tiny snake-like fish in the lakes.

There's a lot of sport fishing pressure in the high Sierras. More investigation into the effects of fish stocking is needed to determine what is necessary to sustain biological diversity in these areas. Currently, plans are underway to recommend management changes (fewer stocked lakes) that will be evaluated through an adaptive management project. Matthews and Knapp are proposing that, to protect frog populations, fish stocking should be terminated in some lakes, and fish should be removed through the use of gill nets. However, because stocking is controlled by the California Department of Fish and Game, it will have to approve any management changes.

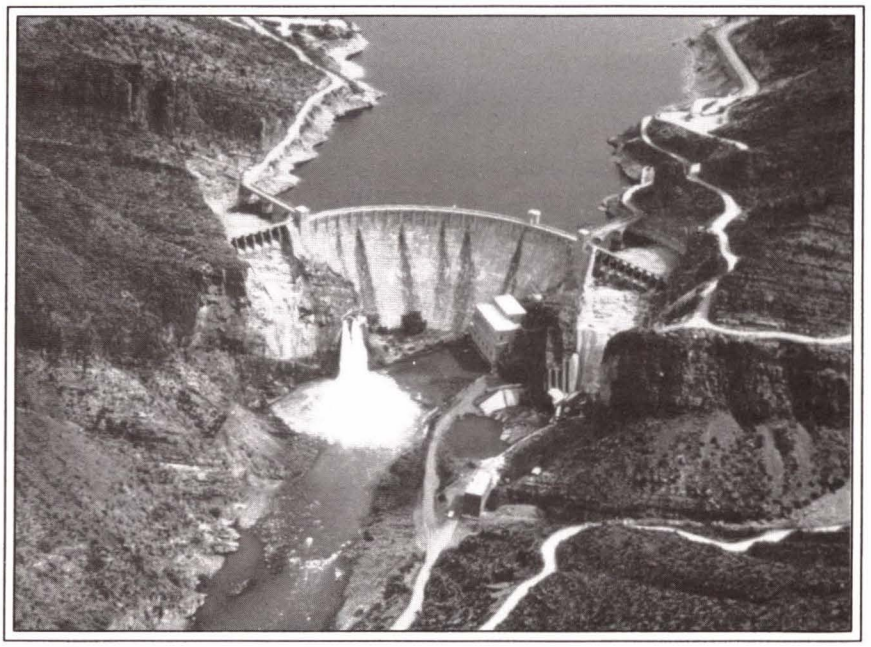
Another proposal is a working conservation agreement for the mountain yellow-legged frog, to prevent its ESA listing.

If you would like to know more about this research, contact Aquatic Ecologist Kathleen Matthews at (510) 559-6454; E-mail: kmatthews/psw@fs.fed.us.

Instream Flow:
A Multifaceted Issue

A book review
by Rick Fletcher
Rocky Mountain Research Station

The 20th Century has been an era of astonishing change, and no region typifies that change better than the American West. The population of the 18 western states has increased sevenfold, from 11.2 million in 1900 to 77.2 million in 1990. Only 6 percent of the West's population lived in large cities when the century began, but large cities are now home to 82 percent of westerners. In 1900, 45 percent of the West's workforce was engaged in agricultural pursuits; by 1990, this figure had fallen to just 3 percent.



Along with this growth and change has come changes in the West's water resources. Rivers today are highly regulated and diverted, compared to the largely natural flows found by the settlers in the 19th Century. The West had a few reservoirs, fewer still of significant size, when the Century began. Western reservoirs with a capacity of 100 acre-feet or more now number almost 10,000; there are an additional 20,000 reservoirs of smaller size. The West's surface water is now being diverted to offstream uses at the rate of almost 119 million acre-feet per year.

Deserts bloom and cities and towns prosper, but at what cost?

The result? — deserts bloom and cities and towns prosper, but at what cost? Only in some of the uppermost river stretches and smaller tributaries, and in a few of the West's most isolated areas, does streamflow remain unaltered by diversion or storage projects. With the loss of instream flows has come a significant loss in aquatic and riparian habitat, recreational opportunities, and water quality.

In a new book titled *Instream Flow Protection: Seeking a Balance in Western Water Use*, authors David Gillilan, University of Colorado, and Thomas Brown, Economist with the Rocky Mountain Research Station, describe what is happening in the exciting, ever-changing world of river management in the West. They present the multifaceted issue of instream flow in its full complexity, presenting along the way some basic concepts and principles that can help in reaching a wise division between instream and offstream water use.

Why all the fuss?

"What many people don't realize," says Brown, "is that streamflows in a vast number of the West's rivers and streams have been severely diminished as water has been diverted for offstream use. Each diversion to offstream use leaves less water for the variety of uses that take place within stream channels.

Streamflows support fish, wildlife, and streamside vegetation, and are used for a variety of recreational purposes. Streamflows also enhance the aesthetics of riverine environments and landscapes, maintain the viability of stream channels, and are used to transport goods, generate electricity, and dilute contaminants," he says.

When water is scarce, choices must be made about how it will be used. Laws and regulations protect offstream water available for cities, farms, and industry, but frequently at the expense of water used instream for fish and wildlife, recreation, aesthetics, and other purposes. Allocation priorities often reflect the dominant water uses and values at the time that western water allocation institutions were developed - some in the mid-1800's, when the public sought to encourage the rapid development and settlement of the West.

"But conditions, needs, and values change," says Brown. "Today, you can't read or talk about water policy in the West without coming across the topic of change. Enormous population growth, concentration of the West's residents and economic activity in urban areas, higher standards of living, and increased mobility have all contributed to shifts in the water needs of western state residents."

Brown says they wrote the book to provide a comprehensive understanding of the many issues surrounding instream flow, and to shed new light on a poorly-understood, but very important, natural resource topic. "Conflicts over instream flow sometimes occur because of a difference in values, but they also arise because of misperceptions and confusion about the basic facts of instream flow protection," says Brown. "If the public is to participate more effectively in the policy-making process, it will be necessary to raise the level of awareness about instream flow protection. Policy makers and natural resource managers too often have only part of the information they need to make effective decisions, and may be unaware of the ways in which similar issues have been addressed in other states and situations," he says.

"Perhaps our ancestors, our fathers, we ourselves not too long ago, were willing to throw away as worthless some scenic, recreational, and environmental factors. Perhaps they were regarded as worthless because of their abundance, but now we realize what is left is far from abundant, that it is scarce, partly because we have already thrown away so much, partly because there are now so many of us that we compete with each other for what is left, and partly because the opportunities for enjoyment have been broadened by the automobile and highway."
(Frank Trelease, water lawyer and scholar).

A Look Inside

The early part of the book contains a brief history of water uses and values in the West, and describes the legal systems that have been developed to protect them. Brown explains that water law, like other law, changes over time in response to changes in dominant uses and values. "In recent years there has been a movement away from viewing water solely as an engine of economic development, and toward increased recognition of the ecological and recreational values of water," he says. The book both directly and indirectly constitutes a study of the ways in which laws and policies have changed in response to new values and conditions.

The authors describe in detail some of the most common instream uses of water. They present some of the many factors that must be considered when evaluating instream flow needs, and describe some of the ways in which analysts attempt to quantify those needs.

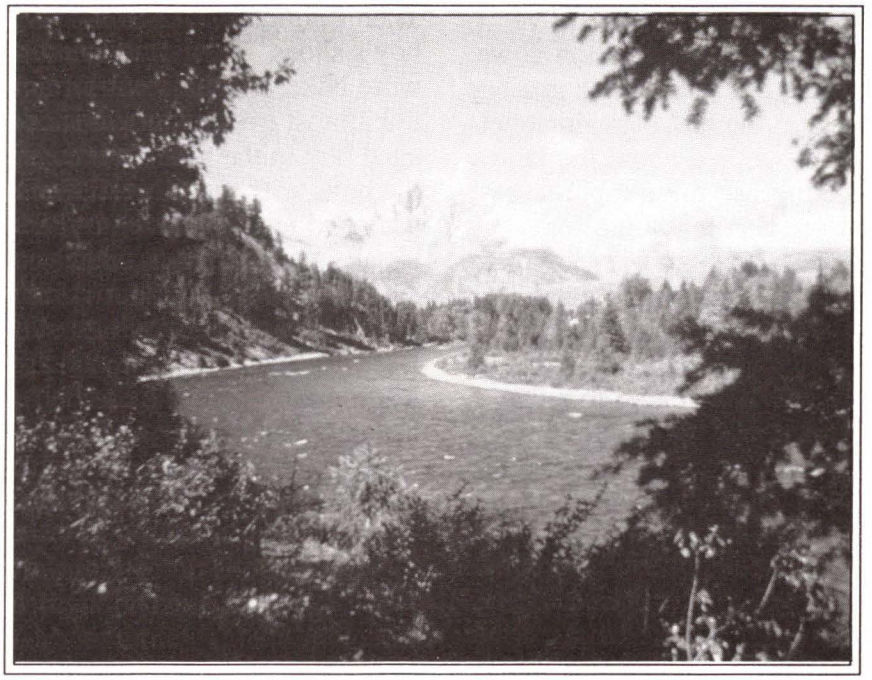
Gillilan and Brown also address perhaps the most basic instream flow protection issue: How much water should be left in the stream? "There is no simple answer to this question," says Brown, "but we present and analyze many of the factors that should be considered during an evaluation of instream flow protection needs."

Many of the basic issues associated with instream flow protection are described, and the ways in which those issues have been addressed by the states. Many of the same issues arise in virtually all of the western states, but they have not always been addressed in the same ways. Brown says that legal and administrative changes designed to accommodate new conditions and values have taken different forms and been given different names, and attempts to review and understand them can lead to confusion. The book emphasizes similarities and enhances understanding of the basic methods used to protect instream flows, and provides information necessary both to think more creatively about solutions to flow problems, and to benefit from lessons already learned through implementation of protection measures in other states.

The writers examine the effects that instream flow protection measures have on other water users. "An evaluation of those effects can be fairly complex," says Brown. "In many situations, instream flow protection measures have little, if any, detrimental effect on other water users, and may even hold positive effects. But the effects on other water users vary with the circumstances unique to each river. In some cases, there are negative impacts that need to be taken into account when considering or designing potential protection measures," Brown explains.

Because the federal government is heavily involved in water management and instream flow protection issues, chapters are dedicated to the many different ways in which the activities of the federal government directly or indirectly affect instream flows, including numerous and varied direct protection efforts. Brown says that instream flow protection efforts of the federal government vary widely by program, agency, and region of the country, but in any form and degree are viewed by many westerners as a threat to existing water users and to state sovereignty over water management.

The authors complete their writing with a summary of the major themes of the book and list the various methods relying on state and federal law that are available for protecting instream flow. They close with observations about the effort to achieve a reasonable balance between instream and offstream water uses. To accommodate readers who wish to research a particular topic in more detail, a substantial number of references to additional materials are included.



This publication constitutes both a comprehensive, integrated introduction to the subject of instream flow protection, and a useful reference for further research and understanding. It should be useful to interested citizens, environmentalists, farmers, ranchers, land and water managers, administrators, policy analysts, policy makers, students, researchers, and others interested in natural resources and environmental management.

The 417-page book is published by, and available from, Island Press, Box 7, Department 2 AU, Covelo, CA 95428, 1-800-828-1302; (E-mail: *info@islandpress.org*; web site: *www.island.org*); prices: $30 paperback, $50 hardcover. (Island Press is a nonprofit organization whose principle purpose is the publication of books on environmental issues.)

Building a Scientific Foundation for the Human Dimension of Ecosystem Management

by David Tippets, Rocky Mountain Research Station

Late one afternoon, I drove from the Ranger Station down off the hill to the little grocery store at the end of main street. People milled about the isles making last minute purchases before heading home for supper. I recognized the young wife and two school-aged children of the rancher with whom I'd just spent the day. The little girl clung to a cart next to her mother; the boy, two years older than the girl, fidgeted and hopped around as though he was restrained by an invisible leash that kept him from running free and wild. He and his sister modeled good behavior. They didn't argue when their mom picked a generic-brand bulk-sized plastic bag of breakfast cereal — even though it was unsweetened, only one color, and never advertised between Saturday morning cartoons on television.

Then I noticed the holes in the boy's shoes. The little boy wore Nike basketball shoes, as did almost every other school-aged boy in the valley — even the boys with real cowboy dads and real cowboy ability usually wore Nike basketball shoes with their Wrangler jeans, tee shirts, and ball caps. But with school having started just a month before, the others had new basketball shoes to wear to school. The current fashion dictated school boys have the high-topped white leather ones that cost a lot of money, and that their mothers always bought about two sizes too large so that they wouldn't grow out of them before the shoes wore out.

The holes bothered me. I looked back at the rancher's son's feet. His shoes weren't too big, I could tell by the white-sock-covered big toe sticking out one of the holes. His mom must have bought those shoes really big because it was clear they were on their second year at grade school. I knew this mom, and I knew she would never put her kids on the bus to begin a new year at school with holes in their shoes unless she had no easy choice to do otherwise.

My mind flashed back to earlier in the day when I'd ridden with their dad to see how much forage their cattle had eaten from their high-mountain summer range on the National Forest. I remembered how big their calves looked. After they sell the calves, I thought, their kids will get new shoes.

The calves had grown fat over a summer with good rain making good feed up on the Forest. The family's grazing permit provided them with good range, with several dependable springs. Geology was their biggest problem, I thought. The water comes out of the ground and never flows far before it falls back into underground streams and rivers. For the entire grazing season most of the cattle don't drink water that isn't piped into a water trough.

The family had already experienced cuts in the number of cattle they were permitted on the Forest; cut back more times than the current file documented. I took their word for the earlier times, recorded in files already shipped to the government's archives. The father was the fifth generation to run livestock on this range. Their patriarch rode into Virginia City, Montana during the gold rush. First he raised horses, but then that first pioneer ancestor spent time in the Montana penitentiary for rounding up too many horses that wore other people's brands. It must have wiped his slate clean in local society because he returned to the same place and grew deeper roots into the same land he'd rustled horses from. The horse market stayed strong through World War I, but then crashed after the war and the family switched to raising cattle at about the same time the U.S. Forest Service started trying to get a handle on livestock numbers.

As I searched the canned goods on the shelf trying to fill my grocery list, I kept glancing sideways at the boy's protruding big toe. The holes in those kid's shoes, and that forest range, connected in both sides of my brain. At no time before in my life had the human dimension of an ecosystem seemed more clearly illuminated. I couldn't escape it. It wasn't just the kids' feet, it was how high those kids held their heads when they walked through the front door of that school in the morning that suddenly seemed relevant to how well I did my job.

Two days later, I saddled up my horse and rode back onto that range to check the progress that the same rancher was making at building a new drift fence to control how his cattle used the range. It was one of those balmy fall days, cold at night but perfectly warm in mid day. The elk were just starting to bugle. Grasshoppers flew noisily in front of my horses hooves as they crunched through the drying grass and now crumbly-crisp brown spring forbs. We flushed blue grouse gathered to eat the grasshoppers on the sunny slope below the top of the ridge.

With just a little planning, noon found me at a good spring where there was a redwood tank installed to water the cattle. The overflow pipe was clogged and water spilling over the sides of the trough had turned the surrounding ground into in a quagmire. My horse was thirsty and willing plunged his hooves through the sucking mud to get a drink from the trough. I swung down from the saddle and stepped onto a basketball-sized rock that kept me out of the mud, leaned over and cleared the algae and debris out of the overflow pipe so that at least for a few days the ground around the trough would have a chance to dry out.

When the horse was through drinking, I held the reins by the ends and hoped from rock to rock until I was on dry ground. The horse turned and followed. I loosened the cinch, tied the gelding to a stout aspen tree, and took my lunch from the saddlebag. I planted myself down a few feet away with my back to a tree where I could look down the canyon and watch the birds and butterflies fluttering around the mud encircled water trough.

An elk bulged in the timber below me. I sat quietly in eager anticipation that the bull would work its way out of the trees to get a drink of water where I could get a look at him. Minutes later, an athletic young man, a fit-appearing young woman, and a golden retriever walked out into the sunlight instead. The young man carried a grunt tube for calling elk and I knew I'd been fooled. Just the same, I remained sitting quietly to see how long it would take for them to spot me.

They were almost to the spring before the golden retriever stopped suddenly, looked up, and barked at me. The people looked up startled and saw the gelding for the first time standing in front of them. I smacked my lips and called to the dog. It came running immediately with its tail wagging, while the woman tried to call it back.

"Hi, beautiful day, isn't it," I called to them.
"You must work for the Forest Service," the young man said.
"Yup, sure do," I said, knowing that it wasn't too much of a feat of deductive logic, since I was wearing a green uniform and a Forest Service badge.
"It would be lot nicer day," the young woman said, *"if the cows hadn't ruined this spring.*
"Nothing wrong with the spring," I said, a little defensively, *"you can climb over that pole fence and lift the lid off the spring box if you want a drink. The water's not tested but I've never known anyone to get sick drinking it."*
"This place stinks," she said, *"I don't know how you can stand to eat you lunch here with all the cow manure and flies buzzing around."*
"You a bow hunter?" I asked the young man, knowing that archery season opened in less than a week.
"Yes," he said, *"I saw this spring marked on a map and hoped we'd find an elk wallow here. We didn't know that the cows would have the place ruined."*
"I can't believe how the Forest Service manages the land for the rich ranchers," the woman said, *"the wild animals and ordinary people like us have just as much right here as the cows. It would be better for most people and the wildlife if the cows were all kicked off the Forest."*
"There's a fair number of elk," I said, *"who still like living here,"* trying to avoid an argument that I knew nobody could win. *"If you cross the fence up on the ridge and head to the west you'll be in an area where there aren't any cows this summer,"* I told them.
"I'm glad there's someplace without cows," he said over his shoulder as they walked away.

So what does this kid's worn out shoes and the young couple at the spring have to do with Forest Service research or the human dimension of ecosystem management? It has everything to do with it, I discovered after two weeks of interviewing scientists and resource managers. No two people I talked to expressed even similar perspectives on how we human beings fit into a sustainable and healthy ecosystem. Yet, we can not separate the human dimension of the ecosystem from the ideas that dwell within our own minds, and nobody's ideas are identical to anybody else's ideas.

In writing this in first person, I confesss my own humanity and subjectivity, born from a culture from which I cannot completely separate myself, I offer a persective on the human dimension of ecosystem management that is no more correct or superior to anyone else's.

First Steps in Probing the Human Dimension

The exploding demand for outdoor recreation that followed World War II stimulated Congress to pass legislation to more intensively manage human use of the public lands. From that legislation grew an new kind of Forest Service research focus on people rather than just natural resources. Economists led the way, and sociologists and psychologists soon followed.

"A whole bunch of synergistic forces came together in the '60's," Research Psychologist Bev Driver (retired, Rocky Mountain Research Station) said recently, recalling the passage of the Multiple Use and Sustained Yield Act, the Wilderness Act, the Land and Water Conservation Fund Act, and then the National Environmental Policy Act at the end of the decade.

The new legislation provided States with Federal funding to help them develop comprehensive recreation plans. Coop units were founded at state universities where Forest Service Research collaborated with them and funded graduate students. Soon, what had started as just a small Forest Service investigation into the human component of forest recreation, developed and spread to universities. There began a natural integration with the economics and tourism research that had been evolving since the '50's. The result was a new branch of traditional forestry and forestry research with a much greater orientation to solving human social problems associated with natural resource management.

By 1973 all of the Forest Service's eight research stations had created human-oriented recreation research programs, and were optimistic that those research programs would grow along with the increasing demands for outdoor recreation.

"As the new research programs started to develop, they tended to emulate the bio-physical research already established," Driver recalls, "and tended to collect data similar to how resource managers scaled timber or threw a hoop over deer pellets."

Collecting data was an expected behavior, according to Driver. Social scientists collected data even before they had defined the problem that needed to be researched. But Driver explains that now, social science researchers understand much better that they need to define the problem before they begin to collect data. They also understand much better that many of the types of methodologies used in research in the bio-physical sciences aren't well adapted to the social sciences.

Economists were probably the first Forest Service scientists to begin probing into some of the human dimensions of an ecosystem. Dollars provided them with a unit of measure to begin quantifying human values. Whether it's related to timber, grass, or elk, economists can begin to directly or indirectly get at he problem of the hole in that kid's shoes. Few would doubt that there's some measurable relationship between the grass growing on that mountain in the National Forest, the cows and elk eating the grass, and the money the kid's parents have to buy new shoes for school.

Next Steps in Probing the Human Dimension

The value of a mountain spring without cows drinking at it presents scientists with a more complex challenge. These are values not easily quantified in units of dollars. In 1991 Rocky Mountain Station scientists Bev Driver and George Peterson joined with the University of Montana's Perry Brown to publish a collection of scientific papers titled, *Benefits of Leisure*. The book represents the investigations of over 50 researchers probing into the benefits to society of leisure time, such as the day spent by that young couple looking for elk in a place where there were no cows. In their minds and in their value systems there was more value in leisure spent on the National Forest in an environment without cattle grazing. But how do we compare that amenity value to society to the commodity value of the shoes that boy had to wear to school?

In every other dimension of an ecosystem we methodically lump and divide species by similarities and differences. Rocks can be sedimentary or igneous, soils organic or mineral, plants monocots or dicots, animals hot blooded or cold blooded. Non of the other dimensions of the ecosystem dispute how we classify them, or fight to defend their interests above the interests of parts of the ecosystem. In the human dimension of an ecosystem, each individual demands respect for their uniqueness, individual values, and individual perspective.

Years after I watched the boy with the holes in his shoes, Interior Columbia Basin Ecosystem Management Project Leader Susan Giannettino, a more articulate Forest Service resource manager than myself, helped me figure out how to explain what happened to me that day, that a shaft of light descended from the heavens into that grocery store and revealed to me in a very personal way a little bit of insight into one human dimension of ecosystem management. Susan explained to me that we can't separate, or more emphatically, that it is impossible to divide, the human dimension of an ecosystem from the rest of an ecosystem because the only place that either one exists, is together inside the heart and mind of a human being. They are both just "constructs" —assemblages of pieces of a puzzle which have started to form a picture that some of us can view and study together. Those of us who share a common culture, with common values, beliefs, and fears, can look at the expanding puzzle, and we are able to see similar images and understand our individual ecosystem constructs in a similar way.

But someone from a different culture, might see it entirely differently, Susan cautioned me, and it wouldn't be wrong. Nor would it be right. There is no right and wrong in how people interpret such inventions of the mind, because it is only through our own values, uses, and language that we can create a construct of the human dimensions of an ecosystem in the first place.

"The range of the human mind, the scale and depth of the metaphors the mind is capable of manufacturing as it grapples with the universe, stand in stunning contrast to the belief that there is only one reality, which is man's, or worse, that only one culture among the many earth possesses is the truth," Barry Lopez wrote in **Of Wolves and Men**.

"To allow mystery, which is to say to yourself, 'There could be more, there could be things we don't understand,' is not to damn knowledge. It is to permit yourself an extraordinary freedom: ***someone else does not have to be wrong in order that we may be right.***"

Right vs. wrong, good vs. bad, black vs. white are concepts ingrained in Euro-American human perspective. The assumption of right or wrong has been at the foundation of conflict in the American West since Euro-Americans first began harvesting the Columbia River Basin's natural resources. In a recent essay, a woman decried the behavior of some Iroquois mountain men through events recorded in the journal of Alexander Ross, a Hudson Bay Company brigade leader who led a mostly Iroquois group into the Snake River Country in 1826. Ross interpreted the Iroquois' behavior through his own proper British values, and then how the author had in turn interpreted his stories about the Iroquois again through a similar Northern European cultural background.

In one word, those Iroquois mountain men were — "naughty." At least they were naughty by the behaviors translated through the minds of two people of an entirely different culture.

No one knows how the Iroquois would have told their own story. Sadly, the Iroquois didn't record the same events in their own language or in their own journals interpreted through their own culture. So at best, we have less than half of a picture of the human dimension of that Hudson Bay Company Brigade's journey into the Snake River country.

Ross concludes his critical account with a short one-sentence paragraph, "The Iroquois alone trapped 3,838 beaver." So perhaps we can at least infer that in addition to being "naughty," the Iroquois were also pretty good fur hunters.

Have we progressed in nearly two Centuries since those two cultures clashed in the Snake River Country? Or, are we still seeing and describing the interactions of humans in the ecosystem through just one dominant Northern European culture? Are the values, fears, and beliefs of another part of the human dimension missing, limiting our view of the human dimension?

"All managerial decisions are moral, not technical," Former Forest Service Chief Jack Ward Thomas testified to Congress in 1994, "because they accommodate some peoples values but not others."

Forest Service scientist George Peterson expanded on this human dilemma in his paper, "Four Corners of Human Ecology: Different Paradigms of Human Relationships with the Earth," included as a chapter in *Nature and the Human Spirit: Toward An Expanded Land Management Ethic.* Peterson defines those four corners of human ecology, or paradigms, as dominion, stewardship, participation, and abdication.

"The values people hold drive their environmental choices, and those values and choices express various positions relative to these for paradigms," Peterson wrote. He suggests how scientists can approach problems in the human dimension, where human values and preferences make it difficult for traditional scientific approaches.

"I accept the scientific method as the correct method of inquiry, but I require it to be guided by systems theory to assure that not only the parts of human ecology, but also the interactive relationships are examined," Peterson explained. " Science may decompose human ecology, but it must not discard the residue of that decomposition. Simply put, knowledge of the parts is necessary and useful, but not sufficient; a scientific holistic approach is needed."

In *Nature and the Human Spirit*, a magnum opus of the human dimension of ecosystems, the contributors explore the differences of perspective between Native Americans, African Americans, Hispanics, feminists, professional wildlife managers, ranchers, outfitters, artists, country folk, suburbanites, and many others. Senior editor of the compilation, Bev Driver, stresses that the volume documents the beginning of new journeys in new directions, rather than the arrival at a destination. Marking the new direction is in itself significant.

"You can not manage natural resources in conflict," Alan Savory, founder of the Center for Holistic Resource Management told Forest Service rangeland managers during the Change on the Range Conference held in Albuquerque almost a decade ago. "You cannot proceed past your weakest link," he continued, explaining that until humans can agree on the important goals, natural resource managers can't properly manage the resources.

Within the traditional culture of science as it has developed since Descartes' time, many members of that culture, seeking to establish their own cultural values of reason and logic above all others, still believe that science can deliver to resource managers one correct, one right, one good solution to the problem. But emerging thought from the social sciences suggests, "Hey, hold on! You may not be asking the most constructive question."

Managers Must Build Bridges

"Moreover, land managers should recognize that the effort to incorporate and balance the diverse values of different groups cannot aim to produce one "right" answer about land management . . ." Oregon State philosopher Peter List and University of Montana forestry Dean Perry Brown wrote in *Nature and the Human Spirit.* "Managers must carefully figure out how to build bridges between groups, find common understanding, and facilitate useful dialogue."

Instead of dedicating years of work and spending millions of dollars to determine one biologically correct answer, perhaps managers should ask, "What can we agree on? What can we begin work on now that will benefit everyone?" After that question is asked first and answered, then the bio-physical scientist can productively frame the researchable questions that those scientists are trained to answer.

These social scientists believe that providing policy makers and resource managers with better information about the human dimension of an ecosystem will help them get to productive points of agreement faster and avoid getting bogged down in conflict for which science can not provide one correct answer for all the different human perspectives.

Perhaps there's a clue in how to better understand the human dimension of an ecosystem by remembering the way that early-day foresters figured out how to protect forests from wildfire. After the deadly 1910 fires in Northern Idaho and Western Montana, the Forest Service decided it was critical to detect and suppress new fires as quickly as possible. That had lots of implications, and among them were building lots of trails into the wilderness and putting lots of lookout towers up on high peaks where a small fire could be spotted when the fire first started.

Those foresters soon discovered that even if one lookout spotted the smoke it could take a long time for smoke chasers to actually find the source of the smoke. If another lookout saw the smoke from a similar perspective it might help located the fire, but it could still take smoke chasers a lot of time hiking over ridges and crossing canyons before they found the flames. However, if they had three lookouts observing the smoke from different perspectives, the lookouts could report the compass bearing from their differing perspectives to where they saw the smoke, and foresters could then "triangulate " the fire's location with a pretty high degree of accuracy.

Just as smoke chasers could get to the fire faster while it was still small by hiking the new trails going in the right direction, so might resource managers and policy makers today address cross-culture human conflicts in an ecosystem, and keep conflicts small through investigating the social element through multiple differing perspectives.

And just as effective fire management often means keeping forest fires small and on the ground, so might effective ecosystem stewardship mean keeping human fires small and on the ground so that they don't become too destructive. Can we stand on common ground, defined by things our multiple cultures value and share — such as, peace, life, social justice, clean water, clean air, and the sustainable production of food and fiber?

Over several years I repeatedly rode up, down, and across that National Forest cattle range with the rancher whose young son started school with holes in his shoes. As we rode together, I never spoke it, but often thought about the holes. Was it my responsibility to see that range produced enough pounds of red meat that his kids could start school in new shoes? Or, was it my responsibility to keep the sagebrush on that hillside for hiding cover when the cow elk dropped their babies there. Or was it my job to save the blue-bunch wheatgrass for elk calves to eat during their first hard winter. Or, perhaps I needed to be more concerned about the hikers who wanted to have lunch at a spring where no cattle watered — a spring without the cow pies and flies buzzing around them.

Maybe what I needed was the humility to understand that I still didn't understand. That that rancher and I shared too similar a perspective to be sure just the two of us alone could fix the problems. That rancher knows there were values harvested when we watched the black bear scurry to cover in the spring time, and heard the bull elk bugle while he gathered cattle in the fall. What we don't know is how to quantify and compare the value of those intangibles with the value of those basketball shoes his son wears to school.

Resource managers and policymakers need help, and Forest Service social, behavioral, and economic researchers are exploring new ways to provide these resource stewards with information and methods to better understand the incredibly diverse and complex human dimension of the ecosystem. When Forest Service Chief Michael Dombeck said that implementing collaborative stewardship was one of his highest priorities, he prescribed an approach to ecosystem management that valued and used all the different human perspectives that could be gathered together. Just like with the multiple fire lookouts, the Forest Service will identify and describe the ecosystem problems and alternative management strategies most accurately if it values and uses broadly differing perspectives.

Gifford Pichot brought from Germany a utilitarian, orderly, and highly regimented style of forestry. History records a division in the conservation movement early in this century where Pinchot's utilitarian forestry played off against John Muir's non-utilitarian philosophy of preservation. Pinchot's philosophy took root and thrived in the USDA Forest Service, while Muir's ideas took root and developed in the USDI Park Service.

Next thing you knew, forests seemed to grow in uniform rows of trees and forest rangers went into forestry schools and then came out thinking, speaking, and acting alike. Along with the profession Pinchot brought from Germany, he brought the Cartesian intellectual tradition that evolved together with the Industrial Revolution. The intellectual tradition included a belief in one right answer, and the companion belief that a small group of educated elite at the top of the organization could determine that one right answer better than all others. For a time, the foresters in the Forest Service thrived on a common vision, mission, and purpose. Foresters did their professional best to manage the National Forests for the "greatest good, for the greatest number, for the long run." Likewise, park rangers in the Park Service thrived for decades with a common vision, mission, and purpose. America's public land treasures were managed with very different perspectives in very different agencies.

While many thrived on the apparent harmony of purpose, List and Brown point out that Yale-trained forester Aldo Leopold did not. Leopold was a Forest Service insider who challenged the wisdom of the utilitarian monoculture. Leopold found value not only in other human perspectives, he recognized the existence and value of non-human perspectives. Bob Marshall and radicals soon followed. The harmony of likemindedness was short lived.

The value for sameness and desire for harmony still haunts many of us. We go to a public meeting hoping, wishing, everyone there could see the great reason and logic behind our science-based management plans. Then we anguish and writhe inside as one person after another articulates a perspective different than our own. Can we prod our own cultural evolution, so that instead of agonizing over a multiple of perspectives, we can celebrated the contribution of diverse perspectives, so that, just like smoke chasers with a triangulated compass bearings, we can arrive faster at the source of the flames?

As we anticipate the dawn of the next milleneum, economists and social scientists strive to develop methodologies that allow us to measure, quantify, and analyze as many aspects of the human dimension of the ecosystem as possible. *Benefits of Leisure* marks our high-water mark in this effort at the close of this Century.

Nature and the Human Spirit: Toward An Expanded Land Management Ethic points like a compass in the direction investigators of the human dimension will proceed in the new millennium to gain a better understanding of those parts of the ecosystems that we don't currently know how to measure with traditional methods. In addition to improving quantitative methods applied to the human dimension, scientists will integrate qualitative studies in ways that broaden our understanding of the human dimension.

What is the value of a high mountain spring — one with no water trough, no mud, no cow pies, no trout, and just a small trickle of water for an occasional elk or butterfly to drink from? This volume does not contain the answer. It does contain strong arguments, however, that there is great value in a mountain spring not used by human beings, their livestock, or the fish they catch. The books referred to illuminate evidence that we have not explored the human dimension of the ecosystem until we have sincerely searched for the answer to such questions.

Both *Benefits of Leisure* and *Nature and the Human Spirit: Toward An Expanded Land Management Ethic* can be purchased from:

Venture Publishing, Inc.
1999 Cato Avenue
State College, PA 16801
Phone: 814-234-4561
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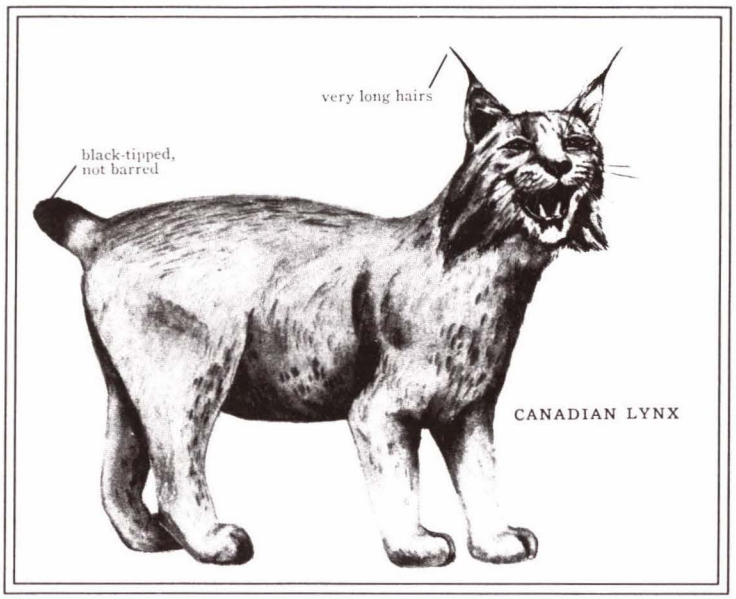
Lynx Conservation Needed to Preserve Species in U.S.

by Sherri Richardson
Pacific Northwest
Research Station

News wire services ran a story last spring stating that the Interior Department might remove about 24 birds, plants, and animals off the endangered list, and that the Endangered Species Act worked and certain species had "sufficiently recovered." As the Fish and Wildlife Service (FWS)— the agency that determines delisting status— decides which wildlife and plants should be removed from "the list," another may be added: the lynx.



The action to add the lynx was initiated when several conservation groups petitioned the FWS to protect the animal. The Forest Service (FS) responded by conducting a conservation assessment on lynx. The assessment findings stated that not enough information was available to design a scientifically credible conservation strategy for lynx.

The Agency recently went one step further and formed a lynx conservation strategy team of which Keith Aubry, a principal research wildlife biologist at the Pacific Northwest Research Station, is a member. He also is a coauther of the assessment of the lynx commissioned by the Forest Service about 3 years ago.

"This is a watershed event," Aubry says. "If the lynx is listed, it would be the first listing of a carnivore in a long time. Although restricted populations of carnivores have been listed recently in relatively small geographic areas, the last time one was listed in an area of a large geographic scope was the grizzly in 1975 and the wolf in 1967."

Aubry's research was published in, *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States,* a General Technical Report published by the Rocky Mountain Research Station. The chapter on lynx (coauthored with Gary Koehler, Washington Department of Fish and Wildlife) provides a framework for management and conservation of lynx in the western mountains and ties the lynx population to the number of hares in the region as the hare is generally the primary food source for lynx.

Are lynx indeed endangered? According to Aubry, lynx are rare in the contiguous United States, with the largest populations present in northeastern Washington and Montana. Lynx populations, he says, are generally stable in Canada and Alaska.

Lynx: Why are They Disappearing?

The ancients believed that lynx had extraordinary powers of vision, thus the term "lynx-eyed." Lynx are mammals with long, soft fur that is longer at the cheeks and usually light brown or grey with darker spots. The animal is smaller than a leopard but larger than a wildcat. It has a short, stumpy tail, and ears tufted at the tip. The lynx's long front legs and broad paws allow it to hunt effectively in deep snow and quickly pounce on its prey.

Not surprisingly, the lynx population is closely tied to that of its main food source: the snowshoe hare. Aubry says hares not only determine where lynx live but also how many lynx will occupy a particular geographic area. The hares are found in northern forests, and like dense conifer thickets where they feed on wood, seedlings, and saplings. The dense forests also help to shield the hares from predators and harsh cold weather.

Hares make up about 35 to 95 percent of the lynx diet. Although they are the main diet of lynx, the animal also feeds on mice, squirrels, grouse, and ptarmigan. But as forests disappear because of human settlements, farming, logging, and other activities, so does the habitat of the hare, thereby impacting the main food requirement of the lynx. Road building for forest management, mining, or recreational purposes also may make lynx more vulnerable to hunters and trappers or possible road death.

What Kind of Habitat do Lynx Need?

Lynx need cover for security and safety when stalking prey. Females use dense, mature forests with large woody debris, such as fallen trees or upturned stumps. The debris provides protection for kittens and a warm cover.

The historic habitat of lynx had been the northern contiguous United States in the Cascade Range of Washington and Oregon, south in the Rocky Mountains to Utah and Colorado, and east along the Canadian border of the Lake States.

"No single management strategy currently exists to manage lynx habitat."

Habitat Strategy Evolves

"No single management strategy currently exists to manage lynx habitat," Aubry says. "But the conservation assessment group that met in Salt Lake City last spring made the decision to produce a strategy that would form the basis for consultations on management actions [that may impact the lynx] proposed on Federal lands if and when the lynx is formally listed. This strategy will be based on a document produced by the science team that will serve to update the lynx chapter from the conservation assessment, create lynx distribution maps, and provide a scientific framework for the conservation strategy."

Considerations for Management

The publication on lynx by Koehler and Aubry suggests the following management and research needs regarding lynx.

Management considerations:

1. High-quality habitat for lynx are a mosiac of early successional habitat with a large population of hare and lots of downed, woody debris for thermal cover and denning.

2. Clearcuts more than 100 meters may create barriers to lynx movement.

3. Hares may not begin to recolonize clearcuts for about 6 or 7 years after the cut.

4. Thinning stands to encourage tree growth can help increase snowshoe hare populations if the stands are thinned before the hares recolonize the area.

5. Small parcels of late-successional forest may be adequate for den sites, but the parcels must be connected by corridors of cover for female lynx to move kittens to den sites that have prey.

6. Frequent small-scale disturbance may provide the best lynx habitat in southern latitudes.

7. The role that insect and disease play in forming suitable habitat should be considered when managing stands. Dead and downed trees provide denning cover.

8. Road management is important. Lynx use roads for hunting and travel, which may make them more vulnerable to human-caused mortality.

Research needs:

1. Studies of lynx distribution and habitat use are urgently needed. Once the study data are available, more intensive field investigation of reproductive ecology, habitat use, and spatial patterns using radiotelemetry will be appropriate.

2. Forest management activities, timber harvest, and prescribed wildfires all will require some experimentation to learn what practices are beneficial to hares and lynx.

What's Next?

The Lynx Conservation Strategy Team is continuing its work. The team, as a Forest Service effort, is funded by the Washington Office and consists of a biological management group that is responsible for writing the conservation strategy, and a science group that will produce a science-based conservation document that will provide the technical basis for the conservation strategy.

Members include Bill Reudiger who heads the biological management group and Len Ruggiero, science group head. Reudiger is the Threatened and Endangered Species Program Manager for the Forest Service's Northern Region and Ruggiero is a Project Leader at the Rocky Mountain Research Station. The other science team members are Kevin McKelvey and John Squires, Rocky Mountain Station; Steve Buskirk, University of Wyoming; Charles Krebs, University of British Columbia; and Gary Koehler, Washington Department of Fish and Wildlife.

"The scientists will update and seek new scientific information about lynx biology and ecology," Aubry explains. "This team will analyze any new information and confer with other lynx experts here and in Canada. We'll also identify where lynx management might be applied on NFS and BLM districts. Our team will also be working to develop reliable methods to survey and monitor the lynx and its habitat."

The document should be completed by summer 1999.

For more information contact Keith Aubry, Olympia Forestry Sciences Laboratory, 3625 93rd Avenue, Olympia, Washington 98512-9193; IBM: kaubry/r6pnw_olympia; phone: (360) 753-7685.

New from Research

Value of Reducing Fire Hazards to Old-Growth Forests

What economic value does the public place on protecting old-growth forests in the Pacific Northwest from fire? And how much are they willing to pay to protect them? These questions are answered by research conducted by John B. Loomis, Armando Gonzalez-Caban, and Robin Gregory.

The scientists surveyed Oregon residents in two random samplings of 500 households each, using two different surveys. In the first survey, people were simply asked about their willingness to pay to protect old-growth forests; in the second survey, they were first reminded about other methods of funding and their own personal budget constraints. The results and response rates between surveys were almost identical: people in the first survey were willing to pay $33 to protect their forests, and those in the second survey were willing to pay $36.

What does this mean to land managers? One of two things: either that respondents already take into account their budget constraints and competing public and private expenditures when answering, or that when dealing with a hypothetical scenario, people do not seriously consider the real dollar consequences of their responses.

A Contingent Valuation Study of the Value of Reducing Fire Hazards to Old-Growth Forests in the Pacific Northwest, Research Paper PSW-229, is available from the Pacific Southwest Research Station (at its distribution center in Fort Collins, Colorado). Supply is limited. This publication is also available on PSW's home page at http://www.psw.fs.fed.us.

###

Assessing Economic Tradeoffs in Forest Management

Methods are described for assessing the competing demands for forest resources in a forest management plan by addressing economic values, economic impacts, and perceptions of fairness around each demand. Economic trends and forces that shape the dynamic ecosystem-economy relation are developed. The method is demonstrated through an illustrative analysis of a forest-management decision in the southern Appalachian Mountains.

For a copy of *Assessing Economic Tradeoffs in Forest Management*, request General Technical Report PNW-403 from the Pacific Northwest Research Station. Supplies are limited.

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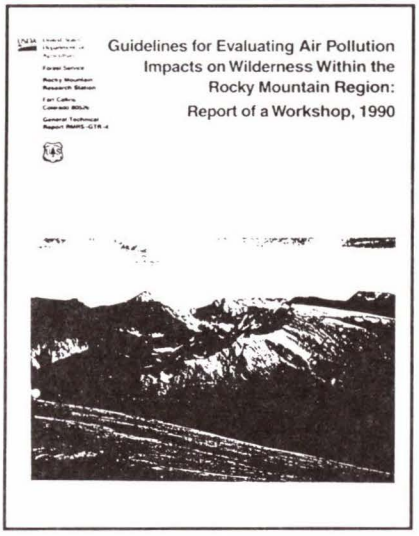
Air Pollution and Wilderness


Guidelines for Evaluating Air Pollution Impacts on Wilderness Within the Rocky Mountain Region: Report of a Workshop, 1990

This document is the product of an ongoing effort begun at a 4-day workshop sponsored by the Rocky Mountain Region, USDA Forest Service, held in December 1990 in Estes Park, Colorado. Participants gathered in groups to work on pollution impacts in three specific areas: aquatic ecosystems; terrestrial ecosystems; and visibility.

The ensuing reports focus on providing the Forest Service with information that may be used to identify and develop sensitive receptors and limits of acceptable change for assessing air pollution impacts on air quality-related values in wildernesses within the Rocky Mountain Region of the Forest Service. The reports also address needs and recommendations relating to modeling or predictive techniques, monitoring, and research. *Guidelines for Evaluating Air Pollution Impacts on Wilderness Within the Rocky Mountain Region: Report of a Workshop, 1990*, General Technical Report RMRS-4, is available from the Rocky Mountain Research Station, while supplies last.

###

Non-Timber Forest Products of Hayfork Adaptive Management Area

Demand for non-timber forest products (NTFPs)—including floral greens, mushrooms, berries, and medicinal herbs—is increasing, particularly in Washington, Oregon, and northern California, and growing numbers of people are enhancing their incomes by harvesting NTFPs from the wild. If forest ecosystems are to continue to produce NTFPs in the long run, harvesters must learn how to gather them in ways that minimize harvest damage to woods and wildlife. This guide, developed in a collaborative effort with harvesters, non-governmental organizations, and USDA Forest Service employees,

describes the preferred habitats, suggested ecologically sensitive harvest methods, economic uses, and local buyers of the 24 NTFP plant species found in the Hayfork Adaptive Management Area on the Shasta-Trinity and Six Rivers National Forests of northern California. The plant species described are grouped according to their sensitivity to harvest, and an illustration of each plant accompanies its description.

Request *A Guide to Selected Non-Timber Forest Products of the Hayfork Adaptive Management Area, Shasta-Trinity and six Rivers National Forests, California*, General Technical Report PSW-162, from the Pacific Southwest Research Station (at its distribution center in Fort Collins, Colorado). Supply is limited.

###

Optimizing Spatial Layout

Spatial Optimization is a methodology used to maximize or minimize a management objective, given the limited area, finite resources, and spatial relationships in an ecosystem. A new book, *Spatial Optimization for Managed Ecosystems*, is now available that presents ideas and methods for directly optimizing the spatial layout of the landscape features in which an ecosystem functions.

The first of four parts treats static spatial relationships that reflect the importance of shape, size, and proximity within an ecosystem. Part 2 considers spatial autocorrelation in a change-constrained modeling framework. Part 3 discusses dynamic spatial changes within modeled ecosystems; and the final section focuses on diversity and sustainability.

Although most discussion concerns wildlife habitat issues, the authors also include chapters on recreation, timber management, water runoff, and pest management.

Authored by Project Leader John Hof and Research Scientist Michael Bevers, both with the Rocky Mountain Research Station, the book is available from Columbia University Press, Order Department, 136 South Broadway, Irvington, NY 10533; phone (800) 944-8648; clothback: $44.00, paperback: $22.00, plus $4.95 shipping.

###

Lithosequence of Soils and Associated Vegetation on Subalpine Ranges of the Wasatch Plateau, Utah

Phosphorus and sulfur in soil and parent material are important in the accumulation of nitrogen and organic carbon in soils. In an observational study, the role of phosphorus and sulfur in soil development was explored on a small knoll in the Wasatch subalpine summer range of central Utah that had been severlely eroded during uncontrolled grazing in the late 1800s. Vegetation, litter, soil, and parent material were sampled along a transect across six strata forming highly visible narrow, concentric rings around the knoll. The data subtly suggest that sulfur may play a key role in the development of these soil-plant systems.

For a copy of *Lithosequence of Soils and Associated Vegetation on Subalpine Range of the Wasatch Plateau, Utah*, please request Research Note PNW-524 from the Pacific Northwest Research Station. Supplies are limited.

####

Forest Sustainability: an Approach to Definition and Assessment

Forest sustainability is a concept for the desired condition of forest ecosystems all over the world. The essential aspects of sustainable forests differ tremendously, however, among peoples of the world. Sustainability needs to be defined to minimize conflict, confusion, and mistrust. For what, where, whom, and how long are forest values being sustained?

Managers and policymakers need to recognize that modern forests practices have a short history and there is little documentation of long-term effects. Increased efforts are needed for well-designed, long-term, and integrated approaches for monitoring forest sustainability.

For a copy of *Forest Sustainability: An Approach to Definition and Assessment*, please request General Technical Report PNW-416 from the Pacific Northwest Research Station. Supplies are limited.

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